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THESIS

MANAGEMENT OF MIFASS,
A MARINE CORPS C^2 SYSTEM

by

Donald L. Geving, II

September 1987

Thesis Co-Advisors: Thomas Hampton
Nancy Roberts

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1. Defining what MIFASS was and the program management structure supporting the program and
2. Analyzing the problems of a flawed acquisition strategy, flawed requirements definition, and a flawed program management structure.

As a result of this analysis this paper concludes the need for establishing a "Marine Corps Systems Command" out of which C^2 programs may be supported, and the opening of a program management office for the acquisition of complex C^2 systems.

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Management of MIFASS, A Marine Corps C^2 System

by

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Captain, United States Marine Corps
B.S., United States Naval Academy, 1979

Submitted in partial fulfillment of the
requirements for the degree of

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from the

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September 1987

ABSTRACT

The purpose of this research was to investigate the problems surrounding the Marine Integrated Fire and Air Support System (MIFASS) Program, managed by the United States Marine Corps. This investigation involved the following:

1) Defining what MIFASS was and the program management structure supporting the program and

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TABLE OF CONTENTS

I. INTRODUCTION..... 9

A. AREA OF RESEARCH..... 9

B. DISCUSSION..... 9

C. OBJECTIVES OF THE RESEARCH..... 10

D. RESEARCH QUESTIONS..... 10

E. RESEARCH METHODOLOGY..... 10

F. SCOPE OF THE THESIS..... 11

G. DEFINITIONS..... 11

H. ORGANIZATION OF THE STUDY..... 12

II. MIFASS SYSTEM..... 14

A. WHAT WAS MIFASS?..... 14

B. MIFASS ACQUISITION AND PROGRAM MANAGEMENT..... 16

C. MIFASS CHRONOLOGY..... 25

III. MIFASS PROGRAM ANALYSIS..... 31

A. FLAWED ACQUISTIION STRATEGY..... 31

B. THE REQUIREMENTS PROBLEMS..... 33

C. OTHER REQUIREMENT SPECIFIC PROBLEMS..... 38

D. MIFASS PROGRAM MANAGEMENT PROBLEMS..... 41

IV. DISCUSSION..... 47

A. FLAWED MATRIX ORGANIZATION..... 48

V. CONCLUSIONS..... 50

APPENDIX A: MIFASS INTERFACE HISTORY..... 53

APPENDIX B: MIFASS PROGRAM MANAGEMENT ORGANIZATION..... 54

LIST OF REFERENCES..... 55

INITIAL DISTRIBUTION LIST..... 57

ACRONYMS

ACAT	Acquisition Category
ACG	Acquisition Coordinating Group
ACMC	Assistant Commandant of the Marine Corps
ADM	Acquisition Decision Memorandum
AE	Acquisition Executive
APO	Acquisition Project Officer
APS	Acquisition Program Sponsor
ASPO	Acquisition Sponsor Project Officer
C^2	Command and Control System
C^3	Command, Control and Communications System
CMC	Commandant of the Marine Corps
DC	Development Coordinator
DevCtr	Marine Corps Development Center
DC/S I&L	Deputy Chief of Staff for Installations and Logistics
DC/S RD&S	Deputy Chief of Staff for Research, Development, and Studies
DirC^4SysDiv	Director Command, Control, Communications, and Computer Systems Division
DPO	Development Project Officer
DSMC	Defense Systems Management College
EDM	Engineering Development Model
FASC	Fire and Air Support Center
HQMC	Headquarters Marine Corps
I&L	Installations and Logistics
ILSP	Integrated Logistics Support Plan
IOC	Initial Operational Capability
JSNS	Justification for System New Start
LSA	Logistics Support Analysis
MAGIS	Marine Air-Ground Intelligence System
MAGTF	Marine Air-Ground Task Force
MCOTEA	Marine Corps Operational Test and Evaluation Activity
MCTSSA	Marine Corps Tactical Systems Support Activity

MIFASS	Marine Integrated Fire and Air Support System
MIPS	Marine Integrated Personnel System
M.S.	Milestone
MSARC	Marine Systems Acquisition Review Council
MTACCS	Marine Tactical Command and Control System
NAVELEX	Naval Electronics Systems Command
NTDS	Naval Tactical Data System
PD	Program Director
PDA	Principle Development Activity
PEO	Principle Executive Officer
PLRS	Position Locating Reporting System
PM	Program Manager
PMO	Program Management Office
RCDC	Radar Course Directory Central
RDT&E	Research, Development, Testing and Evaluation
ROC	Required Operational Capability
SPAWAR	Space and Naval Warfare Systems Command
TACFIRE	Tactical Fire Direction System
TAOC-85	Tactical Air Operations Central 1985
TAOM	Tactical Air Operations Module
TCO	Tactical Combat Operations
TWSEAS	Tactical Warfare Simulation, Evaluation, and Analysis System

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I. INTRODUCTION

A. AREA OF RESEARCH

The purpose of this thesis is to analyze the program management of a major command and control (C^2) system for the U.S. Marine Corps called the Marine Integrated Fire and Air Support System (MIFASS). The acquisition of MIFASS was initiated by a 1975 Marine Corps Required Operational Capability (ROC). Due to problems which caused serious cost overruns and schedule delays, General P. X. Kelley, Commandant of the Marine Corps, recommended to the Secretary of the Navy in June 1987, that the MIFASS program be terminated.

B. DISCUSSION

Only under certain circumstances will the Commandant of the Marine Corps (CMC) authorize the formation of a Marine Corps program management office (PMO), with a senior Marine Officer or DOD civilian chartered with ultimate program responsibility as the program manager (PM). This was not the case from the inception of MIFASS. Program management and direction was accomplished using an informal matrix organized from departments within Headquarters Marine Corps (HQMC), the Marine Corps Development Center (DevCtr), and the Navy Space and Naval Warfare Systems Command (SPAWAR).

C. OBJECTIVES OF THE RESEARCH

The main objectives of this thesis are as follows:

1. Analyze the management aspects related to why the Marine Corps had difficulties in developing MIFASS.

2. Provide broad conclusions about how management problems with the MIFASS program could have been avoided.

D. RESEARCH QUESTIONS

The primary research question is:

What has been the acquisition strategy for MIFASS and what implications has this strategy had for its program management?

Subsidiary questions are:

1. What was the initial management philosophy at the inception of MIFASS.

2. Given the required structure of the DOD acquisition process, how were the issues of program management treated as MIFASS evolved.

3. What C^2 program management lessons can be learned from examining the MIFASS program.

E. RESEARCH METHODOLOGY

The basic research for this thesis was developed from a comprehensive study of Navy and Marine Corps documents and from interviews with the following:

1. Members of the MIFASS Acquisition Coordinating Group (ACG).

2. Staff of the Marine Corps Systems Program Directorate at the Space and Naval Warfare Systems Command (SPAWAR).

3. Mr. Paul McIlvaine, Director of the Technical Management Department, Defense Systems Management College (DSMC).

This thesis topic was selected on the basis of recommendations by Major Jim Haney, USMC, and Captain Larry Lane, USMC, both located at the C^3 Division, Marine Corps Development Center, Quantico, Virginia. These recommendations were based on serious problems that MIFASS had experienced, and that a "lessons learned" type study would be useful to the Marine Corps.

F. SCOPE OF THE THESIS

The general direction of the thesis is to provide broad background information about how MIFASS was managed, and to analyze key decisions that were made in regards to MIFASS development. With this information in mind, general conclusions are made to apply lessons learned and to help avoid problems with future C^2 acquisitions.

G. DEFINITIONS

For the purpose of this study, the following definitions are provided:

1. Acquisition Strategy--Strategy to satisfy an approved mission need that is the conceptual basis of the overall plan that a program manager follows in program execution. It should be structured at the outset of the program to provide an organized and consistent approach to meeting program objectives within known constraints [Ref. 1:p. III-1].

2. Specifications (Specs)--The detailed descriptions of materials, parts, and components used in making a product.

3. Justification for System New Start--Program initiation document required for all Marine Corps programs which have a concept exploration phase in which the projected research, development, test, and evaluation costs are projected to be less than $200 million [Ref. 2:p. B-18].

4. Milestones (M.S.)--Critical points of time where decisions to continue on with a program are made.

   a. M.S. I (1974) for MIFASS was passed after a successful concept exploration phase and the decision was made to begin the demonstration and validation phase.

   b. M.S. II (1979) marked the beginning of the full scale development phase for MIFASS. The engineering development phase for MIFASS began at this point.

   c. M.S. III (1987) normally marks the approval or disapproval for unlimited or limited production. MIFASS was terminated at the M.S. III review. [Ref. 2:pp. II-42-II-50]

5. Marine Systems Acquisition Review Council (MSARC)--This group conducts milestone reviews. The MSARC committee is chaired by the Acquisition Program Sponsor. [Ref. 2:p. IX-32]

6. Acquisition Category (ACAT)--There are four basic categories of acquisition programs. Programs are categorized on the basis of development risks, urgency, congressional interest, joint service involvement, and resource requirements. Because MIFASS was initially programmed for Research, Development, Testing and Evaluation (RDT&E) of under $100 million and over $20 million, it was designated as an ACAT IIc, with CMC acting as the decision authority. [Ref. 2:pp. II-6-7]

H. ORGANIZATION OF THE STUDY

Chapter II provides information on exactly what MIFASS was supposed to be, how it related to other systems, and how the Marine Corps established an organization to manage its development. Chapter III analyzes key problems experienced

by the Marine Corps while establishing what it wanted in the form of MIFASS, and the difficulties in attaining these goals as a result of certain program management flaws. Chapter IV provides a detailed discussion on the flawed MIFASS matrix organization. Chapter V draws conclusions on how the MIFASS program should have been organized.

II. MIFASS SYSTEM

A. WHAT WAS MIFASS?

MIFASS was conceived in the 1960's as a combination of equipment, personnel, and associated procedures that together were to provide the means for exercising command and control (C^2) of fire and air support assets within a Marine landing force. As a system MIFASS was to perform these tasks within a larger architecture called the Marine Tactical Command and Control System (MTACCS). MTACCS was a conceptual association of C^2 systems to support tactical operations in the 1990's. The primary goal of MTACCS was to provide Marine commanders in the field the C^2 capability to assist in countering an expected threat. To attain this objective, the selective automation of various C^2 functions was planned for command levels where they were to be "operationally desirable and logistically supportable." [Ref. 3:p. I-3]

There were seven functions to be performed within MTACCS architecture, they were: fire and close air support, air operations, ground operations, intelligence, personnel, position location information, and analysis and evaluation. MIFASS pertained "to the integrated coordination of fire and air support of ground elements" [Ref. 3:p. I-4]. MIFASS was to provide support in the immediate attack of targets of

opportunity and to give automated assistance in fire planning, target intelligence, counterfire operations, nuclear and biological target analysis, forward area air defense, mission activity reporting and low altitude air space management.

MIFASS centers were to be located at various levels within the Marine Air Ground Task Force (MAGTF) to act as the primary command and control agencies for all supporting arms. Suites of equipment (computers and display devices) were to be constructed around a set of software modules to enable a complete set of system capabilities. [Ref. 3:p. I-5] MIFASS software was originally designed to provide automation to assist the MAGTF in operating within a new tactical doctrine implemented by a system of fire and air support centers (FASC). The FASC concept was to reorganize and centralize the C^2 mission changing from what was the current doctrine which specified a decentralized mode of operation doctrine. FASCs were to "assume the functions of the Marine Fire Support Coordination Center (FSCC), Direct Air Support Center (DASC), and selected roles of supporting artillery and naval gunfire assets assigned the mission of direct support" (Ref. 3:p. II-2].

Within MTACCS and the FASC concept, MIFASS was designed to operate directly or indirectly with six other MTACCS systems (see Appendix A):

1. Tactical Air Operations Central 1985 (TAOC-85)
2. Tactical Combat Operations (TCO)
3. Marine Air Ground Intelligence Systems (MAGIS)
4. Marine Integrated Personnel Systems (MIPS)
5. Position Location Reporting Systems (PLRS)
6. Tactical Warfare Simulation, Evaluation, and Analysis Systems (TWSEAS)

The Marine Corps had for the first time, singly taken on the development of a unique, ambitious, and extremely complex C^2 system. By 1982 these six MTACCS subsystems, along with MIFASS, were either deleted, or had their functions combined. The resulting program consisted of the Tactical Air Operations Module (TAOM, which was also later deferred), the Position Location Reporting System (PLRS), and MIFASS [Ref. 4].

B. MIFASS ACQUISITION AND PROGRAM MANAGEMENT

The program management of MIFASS within MTACCS, was accomplished through a decentralized assemblage of personnel and offices from Headquarters Marine Corps (HQMC), the Space and Naval Warfare Systems Command (SPAWAR), Marine Corps Installations and Logistics (I&L, technically part of HQMC), and the Marine Corps Development Center (DevCtr). (see Appendix B)

1. HQMC Staff

The Commandant of the Marine Corps (CMC) was authorized to make the final Acquisition Category IIc (ACAT IIc) recommendation for MIFASS to the Secretary of the Navy.

When the MIFASS program was determined untenable, he made the ultimate recommendation in May 1987, to terminate the program [Ref. 4].

The Assistant Commandant of the Marine Corps (ACMC) was designated as the Acquisition Executive (AE). As the AE, he was required to monitor and control the acquisition management of MIFASS and to report to CMC. The AE had the decision authority on MIFASS acquisition policy, and ultimately was the person who recommended to CMC that MIFASS be terminated.

The ACMC chaired an ad hoc group of selected general officers called the ACMC committee. The purpose of this committee was to act as a program review body, and not as a milestone review. As problems with MIFASS schedule deadlines and cost overruns became more serious, the ACMC committee met frequently, and assumed many of the responsibilities previously held by the Acquisition Program Sponsor (APS) [Ref. 4].

The next agencies in the chain of acquisition management for MIFASS were the Deputy Chief of Staff for Research, Development, and Studies (DC/S RD&S), and the Deputy Chief of Staff for Installations and Logistics (DC/S I&L).

The DC/S RD&S acted as the principle executive officer (PEO) for MIFASS development up to the Milestone III

decision point. With regards to MIFASS, DC/S RD&S had the following major responsibilities:

a. Coordinating the staff review and approval of all MIFASS program initiation requirement documents.

b. Directing, supervising, coordinating, and monitoring MIFASS to ensure a logical link between mission needs, research development test and evaluation (RDT&E), and procurement.

c. Preparing MIFASS acquisition decision memorandums (ADMs) for submission to CMC.

d. Coordinating with the APS ensuring program documentation was complete.

e. Coordinating the conduct of testing and evaluation of MIFASS (The director of the Marine Corps Operational Test and Evaluation Activities, MCOTEA, was responsible for independent test and evaluation of MIFASS).

f. Providing the development coordinator (DC) to the acquisition coordinating group (ACG).

g. Coordinating acquisition of MIFASS with DC/S I&L to facilitate the conduct of logistics support analyses (LSAs) and integrated logistics support plans (ILSPs) [Ref. 2:pp. III-8-9].

The DC/S I&L would have been the PEO for the AE had MIFASS reached the production and deployment phase. His major responsibilities were:

a. Initiating planning for ILSPs early in the development phase.

b. Coordinating the ILSPs up to Milestone III.

c. Conducting LSAs and ILSPs as soon as possible after the MIFASS program initiation.

d. Providing the acquisition project officer (APO), who is a member of the acquisition coordinating group (ACG).

e. Ensuring that reliability, availability, maintainability, and quality assurance considerations were given appropriate emphasis during MIFASS development. [Ref. 2:p. II-10]

Also located below the ACMC, but maintaining a division status, was the Acquisition Program Sponsor (APS), Director, Command, Control, Communications, and Computer Systems Divisions (DirC^{4}SysDiv). His purpose was to act as APS for all ground tactical command, control, and communications systems, of which MIFASS was included. He was to ensure "the interoperability, intraoperability, compatibility, and the interface" of MIFASS with associated communication equipment in the Marine Corps. [Ref. 2:p. II-14] He was also a reviewer on all proposed program initiations, and requirements involved with MIFASS. His major responsibilities also included:

a. Acting as the principal Marine Corps point of contact for providing management and planning guidance for MIFASS.

b. Assessing the capabilities, suitability, and cost effectiveness of the system throughout the life cycle of the program (technology risks, program tailoring, ILS, personnel and training requirements, etc.).

c. Providing the MIFASS acquisition sponsor project officer (ASPO), who is a member of the acquisition coordinating group (ACG).

d. Initiating the mission area analysis for MIFASS to determine operational requirements. [Ref. 2:pp. II-16-18]

2. The Marine Corps Development Center

The Director of the Marine Corps Development Center (DirDevCtr) came under the staff cognizance of the DC/S RD&S

during MIFASS development. This relationship was not a command relationship, but as a provider of updates on the status of the hardware and software development of MIFASS. His major responsibilities for MIFASS included:

a. Managing the Marine Corps Long Range Studies Program that generated a need for MIFASS.

b. Preparing and submitting program initiation and requirement documents to DC/S RD&S for HQMC staffing.

c. Conducting mission area analyses as requested by the APS.

d. Acting as the single Marine Corps agency responsible for the management of the work performed by the MIFASS principle development activity (PDA), and associated contractors related to development, systems engineering, and test and evaluation.

e. Providing the MIFASS development project officer (DPO), who is a member of the acquisition coordinating group (ACG). [Ref. 2:pp. II-19-20]

3. The Acquisition Coordinating Group (ACG)

Out of the structure formed by HQMC and the DirDevCtr, was formed the ACG. This body consisted of a committee of action officer representatives from each of the mentioned agencies. "The members of the ACG [had] responsibilities that [resulted] both in the collective program management using the authority of the APS, and the billet related responsibilities" within one of these agencies [Ref. 2:p. III-4].

Collectively the ACG had several functions within the MIFASS program:

a. Write and execute the acquisition strategy plan (ASP) and the material acquisition process (MAP).

b. Coordinate the actions of its members in meeting program management requirements.

c. Exchange information among ACG members.

d. Document program history.

e. Review program management decisions.

f. Recommend program management actions to the APS. [Ref. 2:p. III-3]

The leading member of the ACG was the acquisition sponsor project officer (ASPO). He was the action officer from C^4 Division who had the systems acquisition responsibility for MIFASS. His primary duties included:

a. Coordinating staff action for the APS pertaining to the MIFASS impact on Marine Corps force structure and training.

b. Ensuring that the Justification for System New Start (JSNS), the Required Operational Capability (ROC), and the Life Cycle Cost Forecast (LCCF) were accurate before submission to HQMC.

c. Developing the MIFASS ASP, MAP and Manpower Training Plan (MTP) with the ACG's assistance.

d. Preparing the program objective memorandum (POM) initiation with the ACG's assistance.

e. Producing written minutes for every ACG meeting.

f. Providing program action recommendations resulting from the ACG meetings, to the APS for approval. [Ref. 2:p. III-7]

The second key member of the ACG was the development project officer (DPO). He was the action officer from the DevCtr who was "responsible to the ACG for the day to day

management of the development program" for MIFASS. [Ref. 2:p. III-10]. His principle responsibilities during the MIFASS program were:

a. To act as the single Marine Corps point of contact up to Milestone III, for tasking the project management echelon of the assigned PDA (Program Directorate 70-42, Space and Naval Warfare Systems Command).

b. Prepare RDT&E work directives to explicitly identify deliverable products, required completion dates, and acceptance authority for MIFASS.

c. Prepare statements of work (SOW's) that specified MIFASS task elements to be performed, acceptance procedures, and required delivery dates.

d. Preparing function documents for MIFASS.

e. Providing periodic program review briefings to HQMC agencies that addressed program costs, schedule, and technical performance, as well as program documentation and expenditure rates.

f. Reporting to the ACG all significant results of conferences, meetings or reviews that applied to the program. [Ref. 2:p. III-11]

A third key figure of the ACG was the Acquisition Project Officer (APO). The APO was a member of the staff of DC/S I&L who was "responsible for the management of the logistical, technical, and engineering aspects of production, fielding, operations, support, and retirement" of MIFASS [Ref. 2:p. III-9] (Because MIFASS was terminated, the APO provided all the logistical support planning, in anticipation of production).

The APO's major responsibilities included:

a. Developing the ILSP for MIFASS.

b. Considering LSA's for MIFASS.

c. Assisting the ASPO and DPO in developing LCCF data to support program initiation and documentation.

d. Influencing development efforts to ensure that reliability, maintainability, supportability, and other logistic requirements were incorporated into the system design.

e. Assisting the ASPO in the programming of funds.

f. Identifying and managing data requirements and delivery during the life cycle of the system.

g. Acting as the single point of contact after Milestone III for tasking the project management echelon of the PDA (Space and Naval Warfare Systems Command). [Ref. 2:p. III-9]

The fourth major participant within the ACG was the development coordinator (DC). He was a member of the DC/S RD&S staff who was assigned to coordinate the MIFASS acquisition program [Ref. 2:p. III-9]. His major responsibilities for the MIFASS program were:

a. Maintaining the master project file as a historical reference of development efforts for MIFASS. He acted as the ACG's expert concerning the system acquisition process, and simultaneously monitored the program for the DC/S RD&S.

b. Assisting the ASPO in preparing the ASP and MAP.

c. Coordinating the staffing and approval for the MIFASS program initiation.

d. Assisting the ASPO in programming the RDT&E funds for executing the development plan. [Ref. 2:p. III-9-10]

The DC along with the ASPO, DPO, and APO were the four most important members of the ACG. Other departments

within HQMC provided ACG members to assist in areas related to the manning, training, testing, and funding for MIFASS, leaving the bulk of the day to day MIFASS development duties to the major players.

The principle development activity (PDA) for the MIFASS program was the Marine Corps Systems Program Directorate (Code PD-70-42) located within the Department of the Navy's Space and Naval Warfare Systems Command (SPAWAR), formerly the Naval Electronics Systems Command (NAVELEX). (see Appendix B; for the purpose of this paper the PDA and SPAWAR are synonymous) The mission of SPAWAR was to support the Marine Corps by providing for the design, development, integration, test and evaluation, and procurement of MIFASS in order to satisfy operational requirements [Ref. 5,6].

The SPAWAR/USMC relationship was one in which SPAWAR managers would receive guidance and direction from CMC, but still reported to the Commander of SPAWAR. (see Appendix B) The Marine Corps provided the funding and requirements for MIFASS with SPAWAR chartered with the program management responsibility [Ref. 5,6]. During development, SPAWAR, DevCtr, and DC/S RD&S were required to maintain close coordination. If production had commenced, SPAWAR would have coordinated all further actions with DC/S I&L and DirC^4SysDiv.

C. MIFASS CHRONOLOGY

The following is a summary of a MIFASS Chronology written by Major John Cockle, USMC, MIFASS ASPO, in May 1986.

In 1972 the MIFASS requirement was validated on a MTACCS test bed established at Marine Corps Tactical Systems Support Activity (MCTSSA). By August 1975 a Required Operational Capability was approved and published, specifying the mission requirements for MIFASS.

March 1976.

A special Marine Systems Acquisition Review Council (MSARC) approved the advanced development of MIFASS using both the FASC concept centralized and then current tactical organization decentralized. It was further specified that even though approval for testing of the FASC concept was granted, it did not signify an approved change in current Marine Corps tactical doctrine.

February 1977.

The MSARC II convened and approved the full scale development of a MIFASS engineering development model (EDM) utilizing both the FASC concept and current tactical organization.

August 1979.

A special MSARC convened to obtain approval for the continuation of the MIFASS program, and to gain approval for fabricating a Marine Amphibious Brigade (MAB) sized EDM. Norden Systems Incorporated, was awarded the EDM contract in September 1979. At this time cost projections were:

R&D	USMC PROCUREMENT
Cost: $71.44 million	Funding: FY 1984
Time: 36 months	IOC: March 1986
EDM Delivery: October 1982	

July 1980.

The ACMC committee met and established a requirement to add a unit level message switch (ULMS) to the MIFASS EDM and to increase MIFASS software documentation. Projected costs at this time were:

R&D	USMC PROCUREMENT
Cost: $92.04 million	Funding: FY 1985
Time: 42 months	IOC: September 1986
EDM Delivery: April 1983	

December 1981.

The ACMC committee was notified that Norden had problems in meeting the April 1983 EDM delivery date due to unforeseen complications in software changes, and the added complexity of message text formats. The committee decided to delete four MIFASS requirements and defer eight others until a later date. A developmental delay of twelve months was authorized. A study group was formed at this time,

chaired by Major General D. B. Barker, DC/S for Training, to review MIFASS requirements. Projected costs at this time:

R&D	USMC PROCUREMENT
Cost: $158.14 million	Funding: FY 1986
Time: 54 months	IOC: September 1987
EDM Delivery: April 1984	

May 1982.

The Chief of Staff's committee reviewed the Barker study. It was decided to continue testing of the EDM using the FASC concept and then current tactical organization.

July-December 1982.

An additional development cost of $10.5 million for the interface software for the Digital Communications Terminal (DCT), and PLRS was approved. This software was deemed necessary to take advantage of PLRS location information. A further expense of $1.5 million was also incurred for the development software for a message distribution system. An additional $2 million was spent to evaluate the suitability of integrating MIFASS and TCO.

1 June 1983.

The ACMC committee convened to review two ADMs:

1. Approval for the modification allowing a six month extension for the EDM delivery date.
2. The requirement for ACMC approval prior to the expenditure of more funds on MIFASS.

The decision was also made to conduct Operational Testing-II (OT-II) using only current organizational tactics. The work around for software changes was estimated at $3 million.

April 1984.

The ACMC committee assembled to accept Norden's proposal for "Release 6" software improvement (Artillery Fire Plan/ Fire Plan execution functions) to be separated from the rest of MIFASS software. Projected costs at this time:

R&D	USMC PROCUREMENT
Cost: $172.22 million	Funding: FY 1986
Time: 60 months	IOC: April 1988
EDM Delivery: October 1984	

July 1984.

The ACMC committee met to discuss a five month EDM extension due to the implementation of required software, and to decide upon associated cost increases. A Norden proposed 50/50 cost sharing arrangement for an estimated $13 million in software development, was approved. SPAWAR was directed to negotiate a cap on development costs with the contractor. Projected costs at this time:

R&D	USMC PROCUREMENT
Cost: $187.47 million	Funding: FY 1987
Time: 65 months	IOC: FY 1988
EDM Delivery: March 1985	

August 1984.

The ACMC committee received notification that Norden had rejected a cap on costs for MIFASS. It was agreed that Norden would use $1 million of its own funds and that "Release 6" software would be delivered with the EDM. No

further government funding was provided. Projected costs at this time:

R&D	USMC PROCUREMENT
Cost: $188.64 million	Funding: FY 1987
Time: 65 months	IOC: FY 1988
EDM Delivery: March 1985	

May 1985.

The ACMC committee met to modify MIFASS acquisition strategy. It was decided that a modified "Release 6" software package be completed with full capability included either in the MIFASS production model or in the preplanned product improvement plan (P^3I). It was decided that the delivery date of the system be extended thirteen months and that the Marine Corps would allow $7 million more funds to be expended. Projected costs at this time were:

R&D	USMC PROCUREMENT
Cost: $201.88 million	Funding: FY 1989
Time: 78 months	IOC: 2nd Qtr, FY 1992
EDM Delivery: April 1986	

At this time $52.18 million of the $201.88 million total R&D cost had been absorbed by the contractor.

October 1985.

The ACMC committee made three determinations:

1. The PDA was to develop an acquisition plan based on competition for the MIFASS production contract.
2. The PDA was to develop a finite list of required modifications.
3. The PDA was to complete a detailed R&D plan for MIFASS by task and year.

4. The PDA was to provide the pros and cons of MIFASS as perceived by past and present First Marine Amphibious Force Test Directors.

March 1986.

The ACMC committee received a proposed improved acquisition plan from the PDA. The finite list of required modifications was presented totaling $19.8 million.

May 1986.

A meeting chaired by the DC/S RD&S, including key ACG members and contractor representatives, discussed the contractor's efforts required to prepare the MIFASS EDM for OT-II. Milestone III was anticipated in June 1987. [Ref. 7]

May 1987.

The ACMC recommended to CMC the termination of MIFASS. Total funds spent on MIFASS exceeded $236.08 million [Ref. 8].

NOTE: Monetary figures utilized in this chronology were computed by taking current fiscal year dollars, and converting to 1989 fiscal year dollars. Conversion was accomplished by using weighted escalator factors for 1989 dollars. A document with these factors, dated 1 February 1987, was provided by the Programming and Budget Branch DC/S RD&S, HQMC.

III. MIFASS PROGRAM ANALYSIS

Chapter II identified the fact that MIFASS was a complex system. In this analysis, three major problems have surfaced as the fundamental weaknesses of the MIFASS acquisition effort: a flawed acquisition strategy; poor requirements determination; and weak program management. The purpose of this chapter is to analyze these problems in greater depth and to examine the flawed MIFASS acquisition strategy, to illustrate how MIFASS requirements were not properly approached, and to show how the program management structure exacerbated these problems.

A. FLAWED ACQUISITION STRATEGY

The Required Operational Capability (ROC), drafted in 1975, provided the statement of a Marine Corps need for MIFASS. Defined in that document were such things as the threat, operational deficiencies to be overcome, essential performance requirements, interoperability and intraoperability with other systems, and the concept of employment for MIFASS. [Ref. 9] One key flaw of the ROC that caused problems with the acquisition strategy and follow on detailed requirements, was its emphasis on system description rather than stating "required capabilities." Because the sytem described in the ROC greatly exceeded the

levels of detail and confidence normally available when a ROC is initiated, a System Description Document (SDD) was written as a follow-on, to specify more detailed system requirements than were available when the ROC was written. [Ref. 10]

According to Mr. Paul McIlvaine, Director of the Technical Management Department at the Defense Systems Management College (DSMC), the initial MIFASS acquisition strategy that was born from the 1975 ROC, had some basic flaws that fostered later problems. As a civilian, and the first APO for MIFASS, Mr. McIlvaine was involved in many of the day-to-day management decisions during the program initiation.

It was McIlvaine's opinion that the formulation of a MIFASS SDD following the establishment of the 1975 ROC, was a non-standard occurrence in systems acquisition management. The significance of the SDD was that it had been translated directly into "Type A" specifications (which are initial specifications) for hardware and software capabiltiies. This process went unquestioned. In retrospect, it was thought that MCTSSA, having conducted the initial concept exploration for MIFASS, and being the organization closest to the specifications requirements, should have written the specifications. [Ref. 10]

The impact of the "unscrubbed specs" on the overall acquisition strategy, was that it may have affected the MIFASS competitive definition (CD) phase. This occurred when CD contracts were awarded to Norden Systems and Hughes Aircraft Company as competitors for the follow on Engineering Development Model (EDM). Mr. McIlvaine, believed that the pressures to provide competitive proposals to the governement by these contractors rendered challenges to certain key specifications politically and competitively impossible. In other words, the contractors refrained from questioning certain specifications to avoid appearing unqualified to the government [Ref. 10]

B. THE REQUIREMENTS PROBLEM

As it transpired later, when Norden Systems won the MIFASS CD phase, and began to develop the eventual EDM, the major problem was with too many mandatory requirements for the system software. Because a contractor/government requirements analysis was not adequately conducted, requirements were stuffed into specifications without a realistic challenge as to why they were actually included. [Ref. 10]

The FASC concept for MIFASS turned out to be one of these software related issues, and was ultimately dubbed as the "major perturbation" of the MIFASS program. From the very beginning, there had been serious reservations

concerning the FASC concept, by senior officers in the Marine Corps. The CMC cover letter to the Chief of Naval Material for the 1975 ROC stated that the ROC

> . . .contains changes to current Marine Corps doctrine for the control of fire and air support coordination. As these questions have not been fully addressed within the Marine Corps, the promulgation of this document should not be construed as approval of doctrinal changes by the Commandant of the Marine Corps. [Ref. 11]

It is the opinion of this paper that the question should have been asked: "If this was not approved doctrine, why include it as a required MIFASS operational capability?"

In the May 1976 Acquisition Decision Memorandum (ADM), approval was granted for further testing of the FASC concept. The ACMC, along with CMC, was still leaning toward using the current decentralized approach to making tactical decisions within the system, but decided to defer a final decision on the subject until the MSARC II was held. It also was considered that the equipment specified in the 1975 ROC could support both the FASC centralized and current organizational decentralized structure [Ref. 12] In spite of the fact that the 1975 ROC specified only the FASC concept, the MSARC II held in February 1977 made the determination that the EDM contract would develop and implement both centralized and decentralized tactical organizations. When Norden Systems won the competition for the EDM project in August 1979, software development and

testing commenced until later events necessitated some major changes [Ref. 13]

By December 1981, the ACMC committee recognized that Norden's problems with schedule slippage and cost overruns were becoming serious enough to entertain discussion of MIFASS program termination. The committee directed that a formal study group chaired by Major General D. B. Barker, review the MIFASS requirements, determine its cost effectiveness, and develop recommendations concerning the continuation of the MIFASS program.

It should be noted that in 1979, a newer ROC was written and approved, to supercede the 1975 MIFASS ROC. The 1979 ROC incorporated some relatively minor changes, but it was this latest version that the "Barker Study" considered as a flawed document. As part of the study's recommendation to rewrite a major portion of the 1979 MIFASS ROC, one of the most important issues addressed was the controversy surrounding the implementation of the FASC concept. There were four basic reasons why the study found the FASC concept unacceptable:

1. The FASC was too highly centralized. . .the commander would not be able to handle the volume of information.

2. MIFASS would be located at the Infantry Commander's Tactical Combat Operations Center (TCO); this person did not have the technical expertise to coordinate artillery fire direction and close air support.

3. It shifted too much of the task of tactical fire direction away from the artillery units that were designed to compute firing data.

4. The testing and development of tactics concurrent with hardware and software development was improper. This should have been done before the contract for the EDM was awarded. [Ref. 14:pp. 20-21]

From a contracting and acquisition stand point, the fourth reason became a major issue. The study elaborated that the path chosen for EDM development would complicate operational testing, making it difficult to discern whether problems and deficiencies were attributable to systematic or organizational considerations. It also estimated that operational testing would be extended by at least six months. Additionally, from a life cycle point of view, introducing a new C^2 system along with major changes in doctrinal and functional responsibilities would be most disruptive. [Ref. 14:p. 13]

The study also cited a statistical cost and operational analysis conducted by the Marine Corps Operations Analysis Group (MCOAG) on MIFASS. This analysis was based on simulations at 29 Palms California and the MTACCS test bed at Camp Pendleton California. It indicated that there was no statistical evidence that the MIFASS model operating under the FASC concept, versus a model using the current decentralized organizational form was appreciably faster. It further showed that the proposed monetary savings through a reduced manning level, would be negligible. [Ref. 14:Encl. 6-B-3]

In May 1982, after reviewing the "Barker Study's" findings, testing of the EDM was to continue using the current organizational as well as the proposed centralized FASC tactics [Ref. 15]. The ACMC committee chose not to implement the study's recommendations because they required major changes, and the belief at that time was that MIFASS was only six months away from operational testing. It was not foreseen that MIFASS would actually experience four more years of delays. In December 1982, the Director of the Marine Corps Operational Test and Evaluation Activity (MCOTEA) drafted a letter to the ACMC stating:

> Comparative evaluation of MIFASS with the FASC concept versus current organization, procedures, and equipment, though possible, would not provide a basis on which to draw very meaningful conclusions as to the viability of one organization versus another organization. [Ref. 16]

The significance of this letter further substantiated the "Barker Study's" conviction that organizational issues needed to be separated from the development of the MIFASS EDM. Furthermore, given both MCOTEA's and the "Barker Study's" concurrent evaluation of the FASC concept, any consideration of a mission requirement change of this magnitude, should have forced MIFASS to a MSARC II repeat.

Because of MCOTEA's report, and based on recommendations from DirC^{4}SysDiv (the APS), an ADM dated 17 May 1983 was approved and issued. It stated that the "design and test documentation for the EDM must be modified to utilize

only current organizational tactics" [Ref. 17]. It was envisioned that a software "work around" would result in only a three month slippage in development testing, with the time gained back during a shortened operational testing period. Correcting the original software to accommodate just the current tactical organization, required that Norden Systems change up to a quarter of the software coding for the EDM (approximately 160,000 lines of coding), estimated at a cost of three million dollars. [Ref. 13]

In addition to finding fault with the FASC concept, the "Barker Study" found many other deficiencies with the 1979 MIFASS ROC. These deficiencies included a need for an updated threat statement, improved interoperability capabilities, and the fact that the mobility and transportability of such a huge system was difficult. The study provided a "1982 Proposed ROC" to incorporate its recommendations and conclusions, but it was never approved. [Ref. 14:Encl 5] Even after the FASC requirement for the EDM was changed in 1983, a new ROC was never approved, and the 1979 ROC continued to be in effect until the MIFASS program was terminated in June 1987.

C. OTHER REQUIREMENT SPECIFIC PROBLEMS

Conceptually the basic issue that the Marine Corps precipitated with the establishment of MIFASS requirements, was that it thought it knew what was needed in order to

follow the structure of the MTACCS Test Bed. The Dynamic Situation Display (DSD), mentioned in the 1975 and 1979 ROCs, was a direct outgrowth from the test bed. The difficulty with the philosophy of making such a specific requirement, was that detailed specifications were generated which left the contractor with little design latitude. It minimized the incentive for the contractor to use his own initiative to create software/hardware concepts that may have been more satisfactory. The bottom line was that the ROC was misused and should not have directed a specific solution. It should have carefully stated what capabilities the Marine Corps needed. The question about an MSARC again arises, because theoretically these problems should have been discovered during MSARC proceedings. [Ref. 4]

The requirements for MIFASS intraoperability within MTACCS made it extremely complicated and dependent on schedule completions. It was apparent that the Marine Corps did not carefully follow through on MTACCS as the larger program, of which MIFASS was only a part. Examples of this were the hardware and software applications that MIFASS depended on from TCO. Indications are that not much thought was given to the fact that the Initial Operational Capability (IOC) planned for MIFASS was fiscal year 1986, while the TCO was scheduled for 1988 [Ref. 14:p. 4].

Combined with these problems of intraoperability, was the communications architecture that MTACCS was to operate within called the Landing Force Integrated Communication System (LFICS). This architecture was designed to provide secure digital communications. Many of the MIFASS capabilities were "slaved" to this proposed system, but LFICS, and the digital communications equipment required to support those capabilities never came to fruition. Various development programs for LFICS were either slipped or terminated, the result being that MIFASS did not have the supporting communications equipment that it was designed to work with [Ref. 4].

Besides the intraoperability difficulties, another area where MIFASS had problems, was providing for the automation of unit level tactical artillery fire direction and the abiltiy to interoperate with U. S. Army artillery systems. Because the Marine Corps could not count on having the required volume of naval gunfire support during an amphibious operation, heavy reliance would be placed on various artillery weapons and ammunition combinations. Additionally, with the deferred requirement to interoperate with the Army's Tactical Fire Direction System (TACFIRE), it was decided in 1984 to buy the Army's Battery Computer System (BCS) as a stop gap measure. [Ref. 4] BCS had a character oriented message (COM) format while MIFASS was a

bit oriented message (BOM) system. Additionally, BCS was designed to operate with the more decentralized TACFIRE system while MIFASS was never intended to have a decentralized unit level computer. Again more time and money would have been required to construct a "work around" to incorporate BCS with MIFASS. This would have involved changing 30,000 lines of code at an estimated cost of nine million dollars. [Ref. 4]

D. MIFASS PROGRAM MANAGEMENT PROBLEMS

1. The PDA

The Commandant of the Marine Corps held the authority to assign a Program Manager (PM), approve a charter, and establish a Program Management Office (PMO) to be the primary advocate for MIFASS [Ref. 2]. The question has been asked many times why this was not accomplished. It seems only two explanations can be provided for this, despite policy guidance from the Office of Management and Budget, Circular Number A-109, which advises that government agencies procuring new major systems must "establish clear lines of authority, responsibility, and accountability for management of major system acquisition programs."

The first reason may have been the perception that past arrangements that incorporated ACGs, NAVELEX (later SPAWAR), and HQMC as key figures, had provided an ample management structure. Secondly, Marine Corps specific

programs had historically been relatively simple. For the more complex procurements such as aircraft and other major weapons, "piggyback" buys had been utilized in concert with other service's programs. With these types of arrangements, often times a Marine PMO was not justified. Additionally, the fact that the Marine Corps had always stressed that it was part of the Department of the Navy when it came to systems acquisitions, gave Marine Corps specific programs less visibility. [Ref. 10]

Technically SPAWAR was chartered as the PMO, with the Marine Corps Systems Program Directorate holding the title as PM. As such this activity should have been the primary advocate for MIFASS. However, SPAWAR was never required to do such things as testify before Congress regarding funding. This was because SPAWAR did not have a direct involvement in the Planning, Programming, and Budgeting (PPBS) process. An example of this was during the development of MIFASS, when the DPO was expected to take funding received from SPAWAR and report to the Acquisition Program Sponsor (APS: DirC^{4}SysDiv) how it was expended. Then the APS, not SPAWAR, would act as a supplemental witness with the DC/S RD&S when testifying before Congress. [Ref. 4]

Offices involved with MIFASS had to depend on a somewhat informal matrix organization. A matrix is any organization that utilizes a "multiple command system" which

"includes not only a multiple command structure but also related support mechanisms" [Ref. 18:p.3]. This structure was informal because there was not a specific individual, in the form of a program manager (PM), who was chartered, and singularly responsible to HQMC for the technical and business/financial management for MIFASS. A good matrix organization would have enforced stricter accountability than was present with the MIFASS program.

As was the case with SPAWAR, there was no guarantee that information passed within this informal matrix would be used. The intuitive belief at the beginning of MIFASS was that everyone involved was a Marine, that Marines traditionally worked together, and there was not a requirement to formalize a strong relationship between HQMC and NAVELEX (SPAWAR). The result of this was the informal matrix arrangement that appeared in the PM charter for NAVELEX (SPAWAR). [Ref. 10]

In defense of SPAWAR, it was the responsibility of HQMC to make the ultimate decision on exactly how MIFASS would be managed. The nature of the informal matrix organization is as much a reason for MIFASS problems as anything else. This matrix combined with the many complex requirements contributed significantly to the difficulties of MIFASS program management.

2. The ACG

From the standpoint of the ACG, the day-to-day management by committee of MIFASS had its own peculiar problems. The ASPO would sometimes have difficulty getting all the essential members to attend, just because some persons did not seem to believe it was their job. For example, representatives from DC/S for Training and Manpower indicated it was their assignment only to evaluate, and not to build manning and training requirements for MIFASS, indicates that the distribution of responsibilities had not been defined or understood. [Ref. 13]

Management by committee also made it difficult to gain a fair consensus on certain issues. The situation of short funding, and the APO responsible for logistics, is an example. Situations arose where "Logistics" was short on some issues that were critical to that portion of the program. This would happen as a result of being on the minority side of a critical vote [Ref. 13]. Additionally, every member on the ACG had his own independent chain of command, thus enabling the responsibility and solutions for potentially key issues, to be divided up or approached with different goals in mind [Ref. 8].

As problems increased with MIFASS, the ACMC and his committee actually assumed much of the overall program supervision from the APS. Every major decision on MIFASS

ultimately ended in the committee's hands. Some former ACG members expressed their opinion that decisions made by this committee were not always sound. For example, the update of the Fire Plan/ Fire Plan Execution Function software (going from Release 5 to Release 6) received a negative recommendation from the ACG to the ACMC committee. It was the conviction of the ACG that Norden Systems would not be able to meet its ambitious update schedule. However, Norden officials performed an "end around" maneuver of the ACG. Corporate representatives actually lobbied the ACMC committee in-person, and won approval for the necessary contract modifications. Subsequently Norden did experience schedule problems, and failed to deliver the software modification on time. [Ref. 13]

Foremost on the list of problems for ACG members was the lack of experience and formal education in the acquisition and the Planning, Programming, Budgeting (PPBS) process. When the last MIFASS ASPO assumed his position he was given only a two day class on PPBS, and a half day at Marine Corps Installations and Logistics (I&L) on Marine Corps peculiar budgeting procedures. These two and a half days constituted what was up to that time, his total experience in those areas. [Ref. 13]

Finally, because the Marine Corps had not stressed a strong acquisition program for C^2 systems, very few

individuals who over the years had held key MIFASS management positions, ever received formal acquisition training. Schooling such as the Program Manager's course at the Defense Systems Management College (DSMC), historically has had few Marine Corps graduates. This combined with the fact that individuals rotated out of their jobs every three to four years, tended to hamper program stability and delay the development process. [Refs. 10, 13]

IV. DISCUSSION

Chapter III outlines critical flaws that were prevalent during the MIFASS Program. Given those examples, it is the opinion of this author that when MIFASS was initiated, the Marine Corps was still not totally committed to the program. This is documented by the cover letter for the 1975 ROC to the Chief of Naval Material, and follow-on ADMs related to that ROC. These documents indicated early on that there was considerable doubt in the minds of senior Marine Corps officials about the critical issue of what Marine Corps tactical doctrine MIFASS would support. There was a need for a decision on this issue from the beginning, but apparently senior level interest was not there, nor were the necessary managerial resources dedicated until the program was in serious trouble.

It is a conclusion of this paper that the overall management of MIFASS had flaws that were borne out of this lack of organizational support. The remainder of this chapter will discuss how this lack of organizational support was caused by what this author considers a "flawed matrix organization."

A. FLAWED MATRIX ORGANIZATION

It appears that there was a heavy reliance on an informal matrix organization supporting the MIFASS program. Arrangements for responsibility should have been explicitly established, and provided a more approximate agreement on who was to accomplish specific tasks.

As MIFASS evolved, the ACMC and his committee gradually assumed the duties of what normally would be considered a PMO. The effect was however, that it did not provide for the daily technical management required for MIFASS. Instead, a single full time program manager should have been chartered who coordinated with all key personnel on a regular basis, in order to facilitate important decisions.

Secondly, the concept of management by committee caused a great deal of inefficiency and a loss of effectiveness. Most of the key decisions were hammered out in group meetings. It appears that many of the MIFASS Program decisions incorporated detailed matters in which only several individuals were intimately familiar. Yet the entire committee (the ACG and the ACMC committees) had to listen to the issues being discussed and were expected to participate in and influence decisions.

Some of the individuals in these committees may have enjoyed a steady diet of meetings, but a larger number of people may have felt that their time was wasted, and could

have been better utilized by working in their specialty areas. Again, the cure for this problem would have been the placement of a single PM who understood how a matrix organization was to function. He would then be able to monitor and draw the line between individual and committee matters [Ref. 18:p. 134].

Thirdly, it appears that the MIFASS Program may have suffered from "decision strangulation" [Ref. 18:p. 138]. All issues had to be cleared through at least two committees (The ACG and ACMC committees) before decisions were finalized. This arrangement required each ACG member to have a functional boss, whom he reported to before the ACG met. Reviews then had to be tabled until specialists cleared specific matters with their functional bosses, in essence allowing de facto vetoes over program decisions [Ref. 18:p. 134].

V. CONCLUSIONS

Previous chapters have described in detail three major areas that ultimately doomed the MIFASS program:

1. Poor requirements definition;
2. Flawed matrix organization;
3. Problems with interoperability and intraoperability with other systems.

It is this author's conclusion that some form of a "Marine Systems Command" dedicated to program management, would in the future go a long way toward averting future problems. This command should incorporate the necessary managerial support for acquiring equipment within Marine Corps mission areas, to include systems like MIFASS.

A systems command organized into various divisions, to include a C^3 division, would allow the "pooling" of experienced acquisition professionals. This would enable experts the ability to dedicate themselves in making intelligent and precise decisions when defining required operation capabilities.

Secondly, the establishment of such a command, would help to avoid the "flawed matrix" problems of the MIFASS program. This command would require assigning the necessary contracting, engineering, and business/financial support for Marine systems from SPAWAR. The reason for this is to get all support for future C^2 systems under one organization.

During research for this paper, the author encountered a good deal of "finger pointing" and blaming between SPAWAR and members of the ACG. MIFASS was complex enough without incorporating the somewhat adversarial "we-they" attitude that seemed to exist within the MIFASS program. The presence of this type of conflict may have contributed to some of the difficulties experienced with MIFASS.

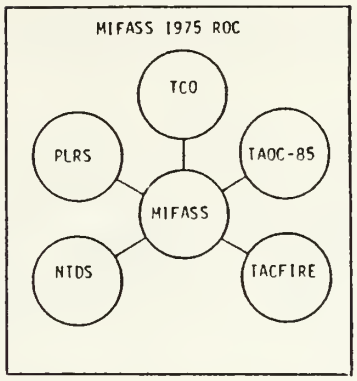
Finally, once a systems command is established, a program management structure could be designed to draw the necessary support required, while at the same time, coordinating development with other concurrent programs. The most likely solution for establishing a good MIFASS management structure would have been to start with a program director (PD) for MTACCS. Answering to this person would be various PMs for the programs within MTACCS, to include MIFASS. The Navy Program Manager's Guide cited the Secretary of the Navy Instruction 5000.1, which stated that a PD must be designated over several PMs for programs within a particular warfare or mission area. It further stated that a PD was to be a line authority, and that no PM should be responsible to more than two levels of line authority. [Ref. 19]

Since MTACCS was a grouping of C^2 functional areas, the logical office to assume the PD responsibility would reside in a related division located within the proposed "Marine

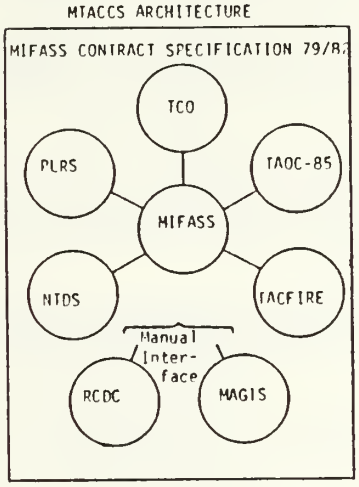
Corps Systems Command." A chartered PM for MIFASS, reporting directly to the PD, would have streamlined the flow of information and decreased the difficulty in accounting for various phases of the program. The PM acting as the primary advocate for MIFASS could then be the single point of contact for all MIFASS related activities, to include responsibility for the exercise of the technical and business/financial management for the program.

APPENDIX A MIFASS INTERFACE HISTORY [Ref. 4]

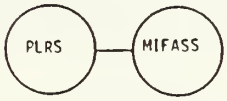
MTACCS ARCHITECTURE



MTACCS ARCHITECTURE

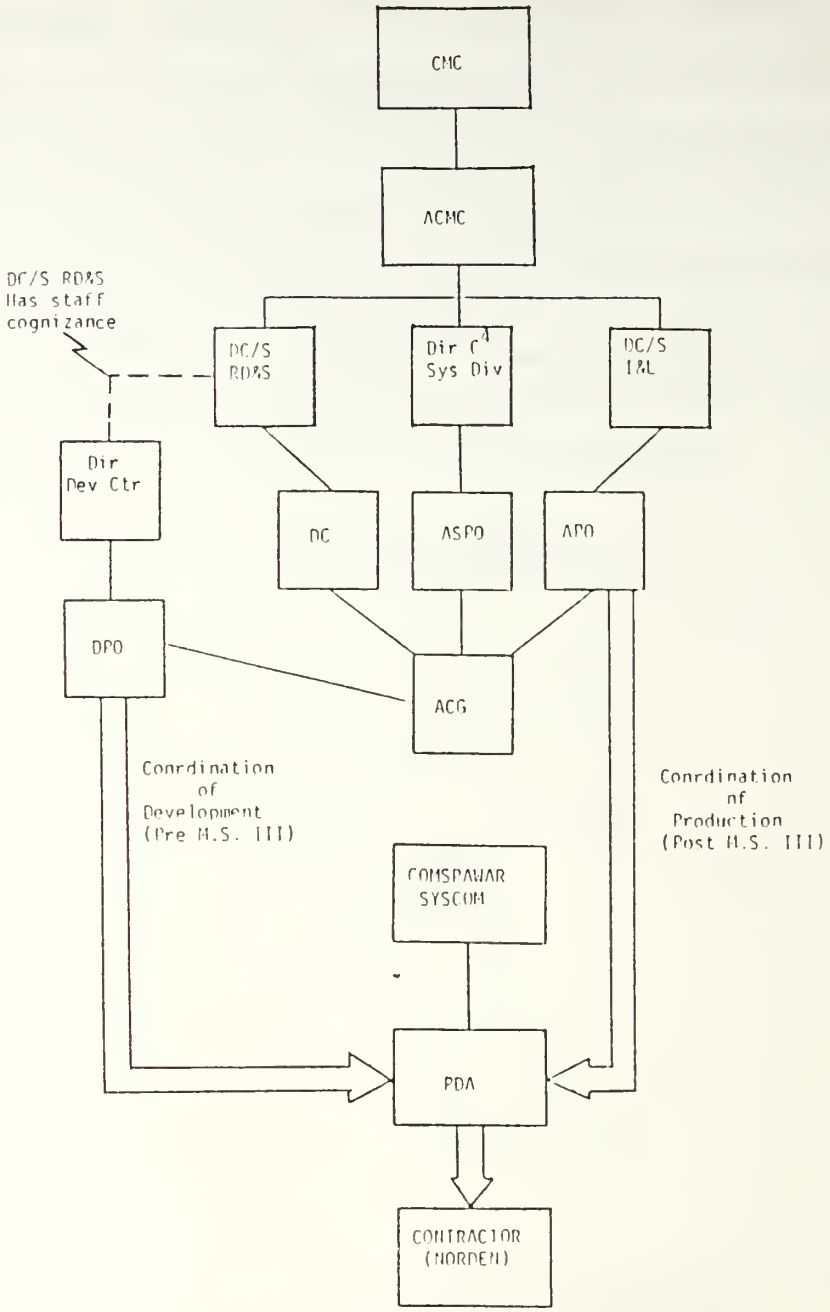


MIFASS EDM 1986



EDM - Engineering Development Model
MAGIS - Marine Air-Ground Intelligence System
MIFASS - Marine Integrated Fire and Air Support System
MTACCS - Marine Tactical Command and Control System
NTDS - Naval Tactical Data System
PLRS - Position Location Reporting System
TAOC-85 - Tactical Air Operations Central-1985
TACFIRE - Tactical Fire Direction System (ARMY)
RCDC - Radar Course Directory Central
ROC - Required Operational Capability

APPENDIX B MIFASS PROGRAM MANAGEMENT ORGANIZATION [Ref. 4]



ACG	- Acquisition Coordinating Group
ACMC	- Assistant Commandant of the Marine Corps
APO	- Acquisition Project Officer
ASPO	- Acquisition Sponsor Project Officer
CMC	- Commandant of the Marine Corps
COMSPAWARSYSCOM	- Commander Space and Naval Warfare Systems Command
DC	- Development Coordinator
DC/S I&L	- Deputy Chief of Staff for Installations and Logistics
DC/S RD&S	- Deputy Chief of Staff for Research, Development, and Studies
DirC4SysDiv	- Director of Command, Control, Communications, and Computer Sys. Div.
DirDevCtr	- Director of the Marine Corps Development Center
DPO	- Development Project Officer
PDA	- Principal Development Activity

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